April 12, 1960 H. F. ODENWELLER 2,932,339

INDUSTRIAL APPARATUS

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FIG. 7.

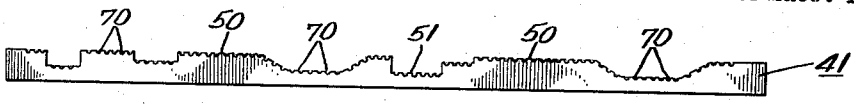


FIG. 1.

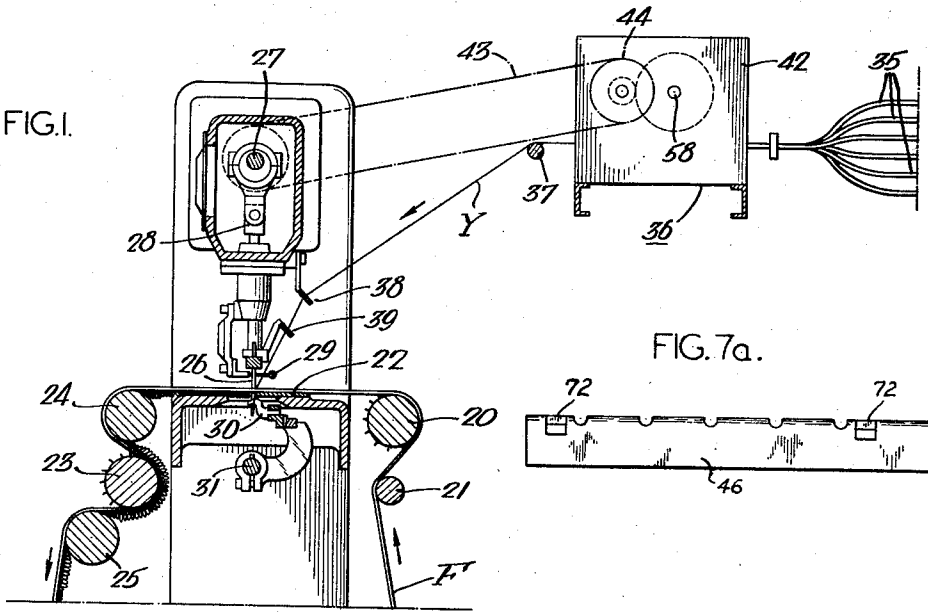


FIG. 7a.

FIG. 8.

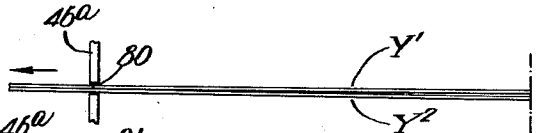


FIG. 9.

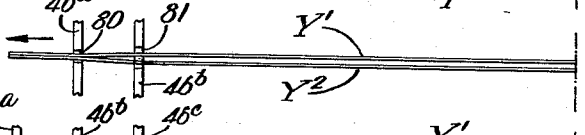


FIG. 10.

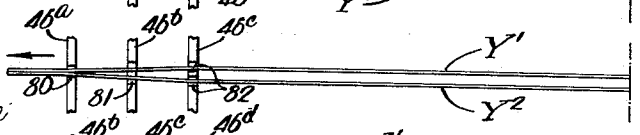


FIG. 11.

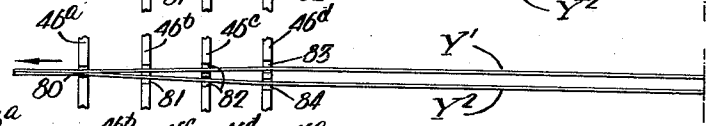


FIG. 12.

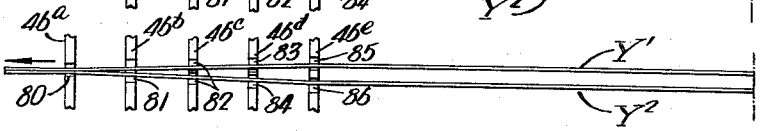


FIG. 13.

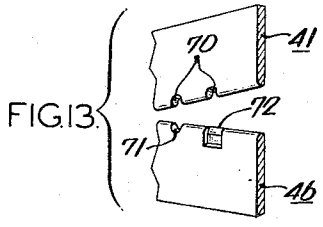
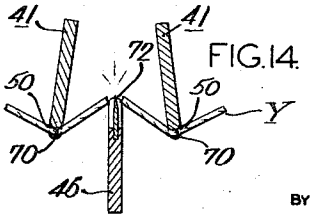


FIG. 14.



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FIG. 2.

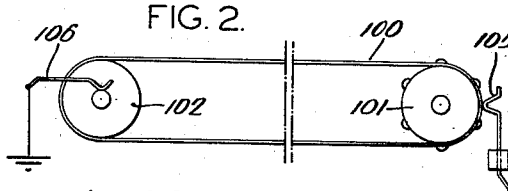


FIG. 3.

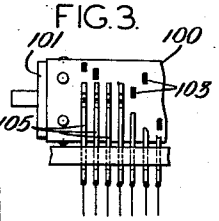


FIG. 5.

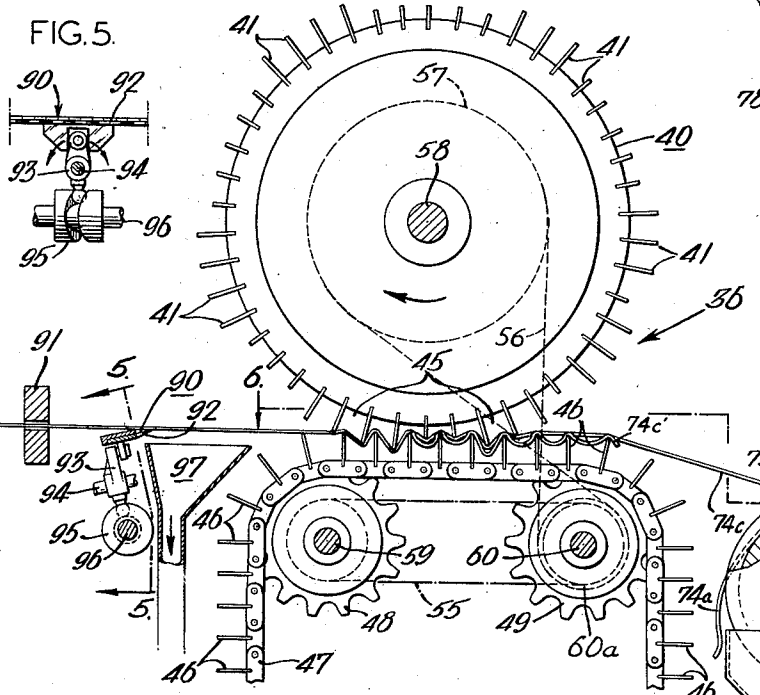


FIG. 6.

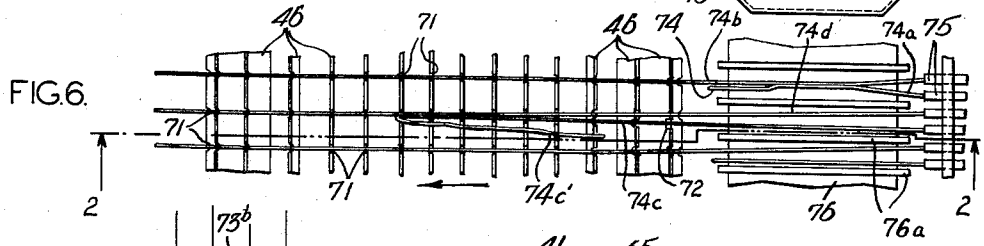


FIG. 4.

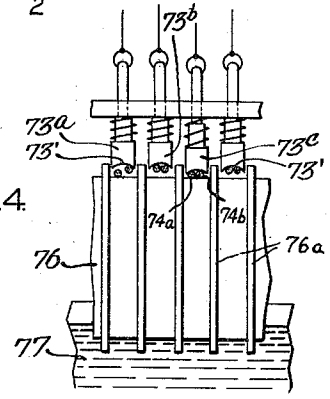
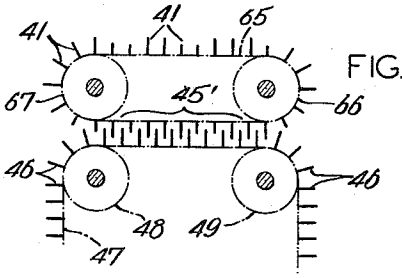


FIG. 15.



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INDUSTRIAL APPARATUS

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Application May 27, 1957, Serial No. 661,900

6 Claims. (Cl. 154—1.7)

This invention pertains to apparatus for manufacturing pile fabrics and more particularly to a yarn control device by which a selection of yarn ends and a sculptured effect may be achieved in a tufted rug or carpet.

The present invention is related to and represents a further development of that of my co-pending application Serial No. 420,378, filed April 1, 1954, now Patent No. 2,853,032, issued September 23, 1958.

Due to the current demand for tufted pile floor coverings having pile yarns of different height, there has been a determined effort to provide adequate machinery for controlling in accordance with a predetermined pattern the height of individual pile tufts or loops as may be desired. In addition to the ability to provide different height pile in a tufted fabric, it is also a desire of the carpet designer to be able to select or change the color or characteristic of the face yarn at will. In the weaving art such a change can be made to a very limited extent in a velvet loom and to a much greater degree in a Wilton loom equipped with a jacquard. The axminster loom, of course, permits the designer to supply any desired color or yarn for any tuft that he wishes.

A tufing machine of the type used in the manufacture of carpets is relatively inflexible in this regard since the yarns forming the pile are inserted through the backing by needles which, generally speaking, are operative at all times. Therefore, the visibility or predominance of any type of yarn or any color of yarn in the pile depends almost entirely upon the relative height of pile elements of that yarn in relation to the height of the pile elements in the adjoining rows. The present invention contemplates the ability to control the type and color of yarn supplied to the tufting machine by substituting one yarn for another to achieve a desired change in pattern or color effect. So far as known, no other tufting machine is capable of substituting one pile yarn for another during the uninterrupted operation of the machine.

The present invention is, accordingly, directed to the provision of an attachment for a tufting machine, by means of which the pile yarns may be fed selectively to their needles in such fashion that the rows of loops inserted by any needle may vary in color or other characteristic and also in height. In the attachment, means are provided for feeding a selected one of a pair of yarns to each needle and the substitution of one yarn by the other is accomplished in accordance with the requirements of a pattern. The height of the loops inserted by each needle is determined by feeding the yarn to the needle in amounts varying in accordance with a pattern and, when a loop of maximum height is desired, the amount of yarn fed to the needle for insertion as the next following loop is sufficient for such a loop. When a loop of less than maximum height is desired, the yarn supplied to the needle for insertion as the next loop is insufficient to form a loop of maximum height and, as the needle inserts the following loop, yarn is withdrawn or robbed from the preceding loop to reduce it in height. The attachment may be constructed to perform both functions of feeding the two yarns selectively and in varying amounts to produce loops differing in appearance and height or the attachment may operate to perform either function alone.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which:

Fig. 1 is a schematic sectional view of a tufting machine embodying the present invention.

Fig. 2 is an enlarged diagrammatic detail partly in section on the line 2—2 of Fig. 6 and with parts broken away showing the yarn control mechanism,

Fig. 3 is a fragmentary end view of the structure of Figure 2,

Fig. 4 is a detail as seen at 4—4 of Figure 2,

Fig. 5 is a detail as seen at 5—5 of Figure 2,

Fig. 6 is a sectional detail as seen at 6—6 of Fig. 2,

Fig. 7 is a side view of one of the pile height control blades shown in Figure 2,

Fig. 7*a* is a side view of one of the blades provided with cutting knives;

Figs. 8–12 are plan views showing progressively the separation of a pair of previously secured yarn ends,

Fig. 13 is a perspective showing a pair of the blades of Figure 2,

Fig. 14 is an enlarged sectional detail illustrating the operation of the blades of Figure 13, and

Fig. 15 is a diagrammatic view of a modified form.

The invention comprises essentially the provision of a yarn feeder for a tufting machine in which a series of spaced blades mounted on a flexible endless support, such as chains or a belt, cooperate with an array of similar spaced blades with the blades of the two series meshing or interdigitating to control and feed the individual yarn ends. Cutting knives are selectively positioned on certain of the blades so that selected yarns may be severed as they enter the meshing zone. The yarns are supplied to the blades in pairs and, while one yarn of each pair is being advanced by the blades to a needle, the other yarn of the pair is inactive and ordinarily lies with its leading end out of contact with the blades. Whenever the pattern requires that a needle be supplied with the inactive yarn of a pair, the two yarns of the pair are joined adhesively at a place to the rear of the leading end of the inactive yarn. The active yarn then advances the leading end of the inactive yarn with it to and between the blades and, as this is taking place, the yarns are being spread apart to the rear of the lengths of the yarns joined together. When the two yarns are sufficiently separated, a knife on one of the blades severs the active yarn, so that the active yarn to the rear of the point of severance becomes inactive and usually pulls back from between the blades. At the same time, the inactive yarn is drawn through the needle because of its connection to the trailing end of the active yarn. As soon as the trailing end of the active yarn has been inserted into the backing sheet by the needle, the inactive yarn becomes the active one and it continues as the active yarn supplied to the needle until the pattern requires another yarn change and the operations described are repeated.

Referring more particularly to the drawings, the conventional tufting machine shown in Figure 1 feeds a supply of base fabric F around a pin feed roll **20** under control of a guide roll **21**. The fabric F then passes across the bed **22** of the machine and around a pin take-up roll **23** under control of guide rolls **24** and **25**. A bank of tufting needles **26** is oscillated vertically in the conventional manner by means of a crankshaft **27** and connecting rods **28**. The machine is equipped with the usual presser foot **29**, loopers **30**, and looper rockshaft **31**. The yarns Y are supplied customarily from a creel (not shown), from thence through a series of tubes **35, 35** to the yarn feed control assembly **36**. The yarns thence pass

over guide roller 37 and through eyes 38 and 39 to the needles 26.

The control device 36, illustrated in greater detail in Figure 2, comprises in one form a drum or cylinder 40 provided with spaced pattern blades 41, 41 around the periphery thereof. These blades 41 (Fig. 7) are profiled in any manner desired to feed selective lengths of the individual pile ends drawn from the creel and thereby to produce pile loops varying selectively in height. The drum 40 is journaled in a housing 42 and suitably driven from the tufting machine drive by means of a chain or belt 43 and reducing gear 44.

The yarn ends Y are fed across the outer edges of blades 41, 41 through a meshing zone 45 by means of a second series of blades 46, 46 carried on one or more chains or a belt 47 around sprockets 48 and 49. In the preferred form the blades 46 are of substantially equal height so that the amount of yarn drawn from the creel depends upon the radial height of the blades 41 of the series on drum 40 which engage the particular yarn. If the part of the blade 41 engaging the yarn is high, as shown at 50 in Figure 7, a maximum amount of yarn will be drawn from the creel because of the maximum meshing or interdigitation of blades 41 and 46. However, when the part of a blade engaging the yarn is low as shown at 51 in Fig. 7, a minimum amount of yarn will be drawn from the creel and the previously inserted loop will be made into a low loop as a result of loop-robbing. It will be understood that the blades 46 may also vary in height along their length and this provides more varied pattern effects and also increases the permissible range of yarn control.

The chain 47 and the drum 40 operate in timed relation to provide proper meshing of the blades and for this purpose, the sprockets 48 and 49 are connected by means of a chain 55 and the drum 40 is connected to sprocket 49 through belt 56 trained about pulley 57 mounted on shaft 58 on which the drum is mounted. The belt is trained about a pulley 60*a* on shaft 60 carrying the sprocket 49 and the sprocket 48 is mounted on shaft 59. Shafts 58, 59, and 60 may be journaled in housing 42.

Figure 15 shows a somewhat modified form in which two chains are used instead of one chain and a drum. In this case a somewhat longer meshing zone 45' may be obtained. The upper chain 65 is mounted on sprockets 66 and 67 and the chain 65 carries blades 41, 41 and replaces the drum 40.

In order to provide individual control for the yarn ends, I prefer to notch the outer edges of blades 41 as shown in Figs. 7 and 13 at 70, and the blades 46 may or may not be correspondingly notched as shown at 71. The notches 70 and 71 are preferably arranged in accordance with a predetermined pattern so that the lateral distance or spacing between adjoining yarn ends is kept under close control at all times. This feature is of importance when it is desired to substitute one end of yarn for another as will be presently described.

In order that the color or type of yarn in the same row of stitches may be changed, I supply the blades 46, 46 with knives 72, 72 at preselected positions and, when a yarn in engagement with a knife reaches a place where substantial meshing of blades 41, 46 takes place, as between high points 50, 50 on adjacent blades 41 (Fig. 14), the yarn will be cut.

The yarns are supplied in pairs, one pair for each needle, and are directed to the blades 41, 46 by guides 75. At any instant in the operation of the machine, one yarn of each pair is active and is being fed to a needle and inserted thereby through the backing sheet, while the other yarn of the pair is inactive. When the pattern requires that the active yarn be replaced by the inactive yarn, the two yarns are secured together, following which the active yarn is cut by a knife 72.

The securing together of the two yarns is effected by means including a clamp 73, beneath which the yarns of the pair pass. The clamp is one of a series lying above a rotating roller 76 between adjacent circumferential ribs 76*a* thereon, which serve to keep adjacent pairs of yarns separated, and the roller dips into a vessel 77 containing adhesive to a depth such that the surface of the roller between the ribs is continually wet with adhesive. The series of clamps includes a clamp for each pair of yarns and, at the time a connection is to be made between the active and inactive yarns of a pair, the leading end of the inactive yarn, such as the end 74*a*, hangs down along one side of the roller 76, while the active yarn 74*b* of the pair extends between the blades 41, 46 and is being supplied thereby to the needle. Each clamp 73 is normally raised out of contact with its yarns by a solenoid 78 against the action of a spring 79, and, when the solenoid is de-energized, the clamp is forced down by gravity and the spring toward the surface of roller 76. The bottom surface 73' of each clamp is formed with a concave curvature, so that, as the clamp moves down, it causes the two yarns thereunder to be squeezed together. As the leading end of the inactive yarn 74*a* has been resting upon the surface of roller 76 carrying a film of adhesive, the yarn has taken up adhesive so that, when it is forced into contact with its associated yarn 74*b* by the action of the clamp, the two yarns become joined together. When a pair of yarns have been joined as described, the inactive yarn, such as the yarn 74*c*, is carried along by its associated active yarn 74*d* to and between the blades 41, 46 with the free end 74*c*' of the inactive yarn trailing. As soon as the junction between the yarns has been effected, the clamp 73 is raised by energization of its solenoid 78.

The action of the clamps 73 is made clear in Fig. 4, in which clamp 73*a* is shown in raised position with its yarn at the right in contact with the clamp and free of the roller 76 while its yarn at the left is idle and lies with its free end extending down along the front of roller 76 like the yarn 74*a*. Clamp 73*b* is in raised position after its yarns have been joined together and clamp 73*c* is in down position forcing its yarns 74*a* and 74*b* into contact, so that they may be connected together.

After the yarns of a pair have been secured together, they are separated laterally to the rear of their connected portions, in order that the active yarn may be severed and become inactive. For this purpose, the notches 70 in the blades 41 may be dispensed with and the blades 46 immediately ahead of the blade having the knife which is to cut the yarns, may be formed with notches effecting the desired separation. A series of blades 46 having notches for separating connected yarns to the rear of their connection and the mode of operation of such blades are shown in Figs. 8–12, incl.

The yarns Y^1 and Y^2, which have been secured together, are first engaged by a blade 46*a* having a notch 80, which the yarns enter. The next blade 46*b* engaging the yarns has a notch 81, which is substantially wider than notch 80 and permits the yarns to start to separate because of their being supplied through separate guides 75, which are somewhat spaced. The next blade 46*c* engaging the yarns has a notch 82 separated into two parts by a small central projection, while the following blade has two spaced notches 83, 84 for receiving respective yarns Y^1 and Y^2. The fifth blade 46*e* in the sequence has notches 85, 86 sufficiently far apart, so that a succeeding blade may be provided with a knife 72 in line with either of the notches to cut the yarn lying therein. The cutting of the yarn by such a knife is effected as shown in Fig. 14.

During the operations of replacing the active yarn supplied to a needle by the inactive yarn, connected lengths of the two yarns go to the needle and the inactive yarn has a free end 74*c*' which might interfere with the passage of the connected yarns through the needle eye. Means are accordingly provided for cutting the end 74*c*' of the

inactive yarn close to the joined lengths of the yarns, such means including an oscillating cutter assembly **90** lying between the meshing zone **45** of the blades and a yarn guide **91**. The assembly includes a cutter **92** mounted for movement transverse to the yarns on a rocker arm **93** journalled on a shaft **94** and the arm is actuated by a barrel cam **95** on shaft **96**. When a free end **74***c*′ of a yarn emerges from the meshing zone **45**, it is drawn into a vacuum exhaust pipe **97** and the free length of yarn is cut by the cutter **92** and the severed portion drawn off through the pipe by the suction.

It will be understood that the actuation of solenoids **78** is controlled in timed relation to the arrival of a knife **72** in the meshing zone **45** or **45**′ as the case may be. Such selective operation of the solenoids may be arranged through any known electrical energizing means such as a pattern tape **100** mounted on rollers **101** and **102**. The tape **100** is of an electrically conductive material, but is provided with selected areas or dead spots **103**, **103** so that the circuit to solenoid **78** from electrical source **104** is interrupted when the contact finger **105** passes over one of the dead spots **103**. The circuit is otherwise completed through the single contact finger **106** to ground.

It will be apparent from the foregoing that, by the use of sets of blades **41**, **46** of the desired profile, the individual yarns may be supplied to their needles at varying rates, so that the needles produce pile loops varying in height. Variations in the color or appearance of the pile loops in individual rows in the fabric may be effected by providing two yarns for each needle, feeding one yarn at a time to its needle, and changing over from the active to the inactive yarn in accordance with the requirements of a pattern. In order to substitute the inactive yarn of a pair for the active yarn, it is necessary to make use of a pattern device for controlling the means by which the two yarns are joined together and to employ a set of blades **46**, which include blades, such as blades **46***a*, **46***b*, etc., for separating the joined yarns and other blades, which have knives **72** for cutting one of the joined yarns of the pair. The blades **46** of the different types are arranged in their set in accordance with the pattern element, such as the tape **100**, employed in the pattern device and, since the endless support carrying blades **46** may be of indefinite length, no difficulty is encountered in co-ordinating the blades and pattern element.

I claim:

1. Apparatus for feeding a pair of yarns in alternation, which comprises a movable member carrying spaced projections in an endless series, a second movable member carrying spaced projections in an endless series, means for supporting the members with projections thereon

intermeshing, means for guiding the yarns from sources of supply thereof to and between the intermeshing projections, the intermeshing projections on the two members being sufficiently close to form a series of lateral deviations in a yarn between the projections and to hold the yarn against substantial slippage, means for moving the members to cause the intermeshing projections to advance a yarn engaged thereby, certain projections of one series having knives effective to sever yarns engaged by intermeshing projections, and means for intermittently connecting together lengths of the yarns lying ahead of a point, at which one yarn will be severed by a knife on a projection.

2. The apparatus of claim 1, in which the connecting means includes means for applying adhesive to a previously severed yarn, a clamp for pressing into contact a yarn being advanced by the intermeshing projections and a previously severed yarn carrying adhesive, and pattern-controlled means rendering the clamp effective at intervals.

3. The apparatus of claim 2, in which the means for applying adhesive includes a roller, a vessel for holding a bath of adhesive entered by the roller, and means for rotating the roller.

4. The apparatus of claim 2, in which the roller is in position to support a previously severed yarn at a distance to the rear of the leading end thereof, the clamp effects a connection between the yarns over lengths spaced from the leading end of the previously severed yarn, and cutting means beyond the intermeshing projections severs the previously severed yarn between its leading end and its connection to the other yarn.

5. The apparatus of claim 1, in which at least one of the members is flexible and endless.

6. The apparatus of claim 1, in which the projections are blades extending transverse to the direction of yarn travel and a group of blades in the same series as and preceding each blade with a knife are formed with notches in their edges for receiving the connected yarns, the notches acting to separate the yarns progressively and to place one of the yarns in alignment with the knife.

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